Question Number	Scheme	Marks
8 (a)	States or implies that gradient of tangent is 24	B1
	Solves $f'(3)=24$ to find k. E.g $4\times3^2+k\times3+3=24\Rightarrow k=...$	M1
	$3k+39=24\Rightarrow k=\dfrac{24-39}{3}=-5$ *	A1*
		(3)
(b)	$f'(x)=4x^2-5x+3\Rightarrow f(x)=\dfrac{4}{3}x^3-\dfrac{5}{2}x^2+3x+c$	M1 A1
	Substitutes $x=3, y=-\dfrac{3}{24}+5$ into $y=f(x)$ to find "c"	dM1
	$f(x)=\dfrac{4}{3}x^3-\dfrac{5}{2}x^2+3x-\dfrac{141}{8}$	A1
		(4)
		(7 marks)

Mark this question as a whole, some may try finding f(x) first in part (a), so award positively.

(a)

B1: States or implies that gradient of tangent (to the curve at P) is 24. This may occur within the use of the perpendicular condition, e.g. $f'(3)\times-\dfrac{1}{24}=-1$ implies B1.

M1: Attempts to solve $f'(3)=\pm24$ or $\dfrac{1}{24}$ (or equivalent equations) to find k. Accept as minimum at least one unsimplified equation in k before the given answer is stated. Alternatively, allow for substitution of $k=-5$ and $x=3$ into f'(x) and simplifying to a value to compare with the gradient (verification method).

A1*: Shows that $k=-5$ with at least one correct equation with simplified terms (not necessarily all gathered) and no incorrect work shown before stating the printed answer. By verification all steps must be correct with conclusion given.

(b)

M1: Integrates to a form px^3+qx^2+rx, with at least $p,q\neq0$ with no requirement for + c. Allow with k used in place of −5 for this mark.

A1: $f(x)=\dfrac{4}{3}x^3-\dfrac{5}{2}x^2+3x$ with no requirement for + c

dM1: Substitutes $x=3, y="-\dfrac{3}{24}+5"$ into $y=f(x)$ and finds a value for "c". Must have had a constant of integration.

A1: $\left(f(x)=\right)\dfrac{4}{3}x^3-\dfrac{5}{2}x^2+3x-\dfrac{141}{8}$ Accept with $y=$… instead of f(x), or even with no label at all.

Question Number	Scheme	Marks
9 (a)	$x \ldots -5$	B1 **(1)**
(b)	$\mathrm{f}(x) = (x+5)\left(3x^2 - 4x + 20\right) = 3x^3 + 11x^2 + 100$	M1
	$\mathrm{f}'(x) = 9x^2 + 22x$	M1 A1cso **(3)**
(c)	Finds $\mathrm{f}'(-4) = 9\times\left(-4\right)^2 + 22\times -4 = \left(56\right)$	M1
	Sets $\mathrm{f}'(x) = "9x^2 + 22x" = "56"$	dM1
	$9x^2 + 22x - 56 = 0 \Rightarrow x = \frac{14}{9}, \left(-4\right)$	ddM1 A1cso **(4)**
(d)(i)	$\left(-1, 84\right)$	B1
(ii)	$\left(-4, 336\right)$	B1 **(2) (10 marks)**

Note: mark the question as a whole – do not be concerned if there is incorrect part labelling.

(a)

B1: Correct range of values given, $x \ldots -5$ or exact equivalent in set notation. Must be clearly identified as the answer, do not isw if a different range is given later but allow if $x = -5$ is stated as well as the range.

(b)

M1: Attempts to multiply out to form a cubic (which may be unsimplified), achieving at least $3x^3 + ... \pm 100$ with at least one x or x^2 term between, and allow if there are extra constant terms between too.

M1: Differentiates to form a quadratic. Power decreased by 1 at least twice.

A1cso: $\mathrm{f}'(x) = 9x^2 + 22x$ Must have come from a correct expansion.

The product rule may be attempted:

M1: For $\mathrm{f}'(x) = (1)(3x^2 - 4x + 20) + (x+5)(Ax + B)$

M1: Expands and simplifies to a quadratic as long as a sum of terms was attempted.

A1: $\mathrm{f}'(x) = 9x^2 + 22x$

(c)

M1: Finds $\mathrm{f}'(-4)$ for their $\mathrm{f}'(x)$

dM1: Sets $\mathrm{f}'(x) = "9x^2 + 22x" = "56"$ with their derivative and value.

ddM1: Solves their $"9x^2 + 22x = 56"$ which must be a 3 term quadratic. May be implied by the correct answer for their equation.